

WATER POSSIBILITIES FROM THE
GLACIAL DRIFT OF
WORTH COUNTY

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Water Resources Report 5

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OF WORTH COUNTY

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MISSOURI GEOLOGICAL SURVEY AND WATER RESOURCES ROLLA, MO.

William C. Hayes, State Geologist and Director

WATER POSSIBILITIES FROM THE GLACIAL DRIFT OF WORTH COUNTY

A special study of groundwater by the Missouri Geological Survey and Water Resources was made possible at the 1955 session of the Missouri Legislature. With the approval of the Governor, money was appropriated from the Missouri Post War Surplus Reserve Fund.

Since nearly two-thirds of the counties located north of the Missouri River are deficient in water supplies, much of the effort of this special study is being directed toward the problems of this area.

It has been shown that a program of test drilling can locate new reserves of groundwater. Potential areas are being tested so that additional supplies will be available for domestic, irrigation, industrial, and municipal needs.

The most favorable areas are in the sand and gravel filled channels and valleys of pre-glacial and inter-glacial streams. Since these buried valleys do not conform to present day drainage patterns, a systematic program of test drilling is a principal means of locating the channels and mapping their extent. Such glacial deposits have proved to be excellent sources of groundwater.

QUALITY OF WATER FROM ROCK WELLS

The water from the consolidated rock formations which underlie Worth County is, for the most part, presumably mineralized. No analyses are available.

Referring to Plate 1, it will be noted that a large area of Worth County is unfavorably located to obtain water from glacial drift. Wells drilled into the consolidated rock to moderate depths may possibly obtain limited yields of water of marginal quality. The water from "rock" wells in all probabilities will become more mineralized with increased depth of drilling.

QUALITY AND QUANTITY OF WATER FROM STREAMS

The streams of Worth County are intermittent in their flow. Though

the quality of the water is usually satisfactory, the undependable flow makes them unsuitable for irrigation or for municipal use. No analyses are available.

QUALITY OF WATER FROM GLACIAL DRIFT

In general, the water from the glacial drift is high in total iron, total dissolved solids, and sulfates. The iron content in the water may cause staining of plumbing fixtures and laundry; however, relatively inexpensive water treatment for the iron will prevent this staining. For most types of irrigation, total dissolved solids should not exceed 2000 parts per million and total alkalies should not exceed 75 percent. Most people cannot tolerate water for drinking purposes which contains more than 1500 parts per million of chloride, or 2000 parts per million sulfate. Water with 300 parts per million of chloride tastes salty to some people. Sulfates in excess of 500 parts per million may have a laxative effect when first used for drinking.

The following are analyses from seven glacial drift wells.

CONSTITUENTS	IN PARTS PER MILLION			
	1	2	3	4
Turbidity	Turbid	5.0	10.0	3.0
Odor	None			None
pH	7.5	6.6	6.6	7.2
Alkalinity (CaCO ₃)	200.5	227.0	215.0	264.0
Phenolphthalein	0.0	0	0	0
Methyl Orange	200.5	227.0	215.0	264.0
Carbonate (CO ₃)	0.0	0	0	0
Bicarbonate (HCO ₃)	244.6	277.1	261.6	321.5
Silica (SiO ₂)	11.0	20.0	18.0	8.0
Oxides (Al ₂ O ₃ , Fe ₂ O ₃ , TiO ₂ , etc.)	2.3			
Calcium (Ca)	111.5	109.6	96.6	96.4
Magnesium (Mg)	32.5	21.4	20.3	16.7
Sodium (Na) and Potassium (K) as Na	388.3	17.6	21.6	6.8
Total Manganese (Mn)	0.00			
Total Iron (Fe)	0.46	4.0	2.0	1.2
Dissolved Iron	0.13			
Precipitated Iron	0.33			
Sulfate (SO ₄)	975.3	73.5	69.9	54.3
Chloride (Cl)	50.3	76.1	50.8	9.0
Nitrate (NO ₃)	0.2	9.3	1.3	0.49

CONSTITUENTS	IN PARTS PER MILLION			
	1	2	3	4
Fluoride (F)	0.7			
Total Suspended Matter				
Total Dissolved Solids	1805.	652.0	556.0	498.0
Total Hardness	412.2	362.0	325.0	309.0
Carbonate Hardness	200.5	227.0	215.0	264.0
Non-carbonate Hardness	211.7	135.0	110.0	45.0
Percent of Alkalies	67	10	13	5

1. Owner: Missouri Geological Survey test well number 362, NW $\frac{1}{4}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 1, T. 66 N., R. 31 W. Total depth 216 feet. Well flowed. Temperature of water 50° F., of the air 80° F. Sampled August 7, 1956. Analyst: M. E. Phillips.

2. Owner: City of Sheridan, direct from "old well", September 21, 1956. No other data available. Analyses from the Missouri Division of Health.

3. Owner: City of Sheridan, direct from "new well", August 10, 1955. No other data available. Analyses from the Missouri Division of Health.

4. Owner: City of Grant City, direct from well number 1. No other data available. Sampled April 6, 1948. Analyses from the Missouri Division of Health.

CONSTITUENTS	IN PARTS PER MILLION		
	5	6	7
Turbidity	10.0	140	Turbid
Odor	None	None	Musty
pH	6.9	7.4	
Alkalinity (CaCO ₃)	309.0	498.5	207.4
Phenolphthalein	0	0.0	
Methyl Orange	309.0	498.5	
Carbonate (CO ₃)		0.0	0.0
Bicarbonate (HCO ₃)	375.6	608.2	252.9
Silica (SiO ₂)	26.0	15.2	13.6
Oxides (Al ₂ O ₃ , Fe ₂ O ₃ , TiO ₂ , etc.)		1.8	4.0*
Calcium (Ca)	104.7	96.1	42.4
Magnesium (Mg)	12.5	32.9	9.9
Sodium (Na) and Potassium (K) as Na	9.9	107.8	37.1
Total Manganese (Mn)		0.00	
Total Iron (Fe)	2.8	16.24	14.28
Dissolved Iron		0.09	0.28
Precipitated Iron		16.15	14.00

CONSTITUENTS	IN PARTS PER MILLION		
	5	6	7
Sulfate (SO ₄)	16.6	81.2	3.3
Chloride (Cl)	8.4	4.5	2.7
Nitrate (NO ₃)	0.36	5.1	0.67
Fluoride (F)		0.2	
Total Suspended Matter		138.	
Total Dissolved Solids	452.0	672.	237.0
Total Hardness	313.0	375.4	146.6
Carbonate Hardness	309.0	498.5	146.6
Non-carbonate Hardness	4.0	0.0	
Percent of Alkalies	6	38	35

*Al₂O₃ only.

5. Owner: City of Grant City, "raw water well #2". Sampled March 24, 1949. No other data available. Analyses by Missouri Division of Health.

6. Owner: Gilbert Batt, NW $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 27, T. 66 N., R. 30 W. Total depth 150 feet. Sampled August 8, 1956. Temperature of the water 54° F., of the air 88° F. Analyst: M. E. Phillips.

7. Owner: Frank Campbell, $\frac{1}{2}$ mile east of Allendale. Total depth 30 feet. Sampled February 23, 1939. Analyst: R. T. Rolufs.

QUANTITY OF WATER FROM GLACIAL DRIFT

DOMESTIC WELLS - Included in this category are wells developed for household or general farm use. Yields required from domestic wells vary but seldom exceed 15 gallons per minute. In some parts of Worth County sands and gravels were not deposited in the glacial drift. There are also areas where the glacial drift cover is relatively thin or lacking. In such areas the possibility of developing wells is limited. Plate 1 shows the area most favorable for the development of domestic wells. Plate 3 is a contour map showing the elevation of bedrock above sea level. To determine probable drilling depths, the elevation of the bedrock should be subtracted from the surface elevation for each specific site. Plate 3 also shows the locations of the test holes and the thickness of the glacial drift encountered.

IRRIGATION WELLS - Included in this category are all high yield wells whether used by cities, by industries, or for irrigation. Plate 2 shows

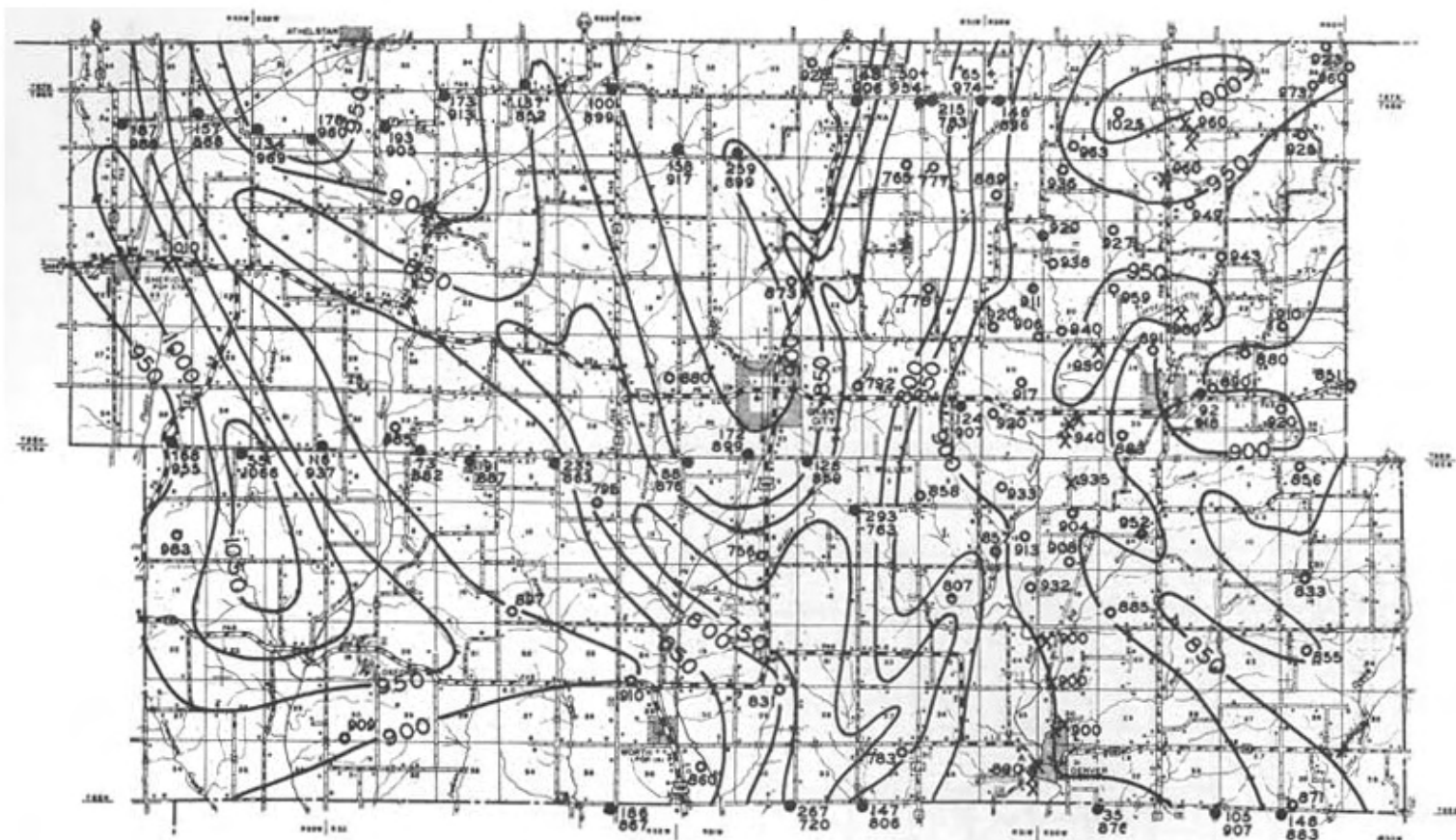
the area most favorable for the development of irrigation wells. Also shown are the locations of wells which flowed.

With proper development, yields of 200-1000 gallons per minute may be obtained. This is an estimate and is not based upon actual pumping tests within the area. Yields to be expected are contingent upon several factors:

- (1) The thickness of the sand and gravel beds.
- (2) The size and sorting of the sand and gravel.
- (3) The manner of construction and materials used, such as proper well screen, gravel pack, etc.
- (4) Ability of the well driller to develop the full capacity of the water bearing sands.

Continued successful production is contingent upon:

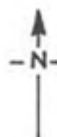
- (1) Re-charge rate of the water-bearing horizons.
- (2) Quality of the screen and materials used.
- (3) Subsequent well treatment such as acidizing.
- (4) Avoidance of over-pumpage.



Base by the Missouri State Highway Department, 1940

LEGEND

- 135
830 Test holes showing thickness in feet of drift and elevation of bedrock above sea level.
- Water wells
- X Bedrock Outcrops
- ✕ Mine or Quarry
- Contour interval 50 feet

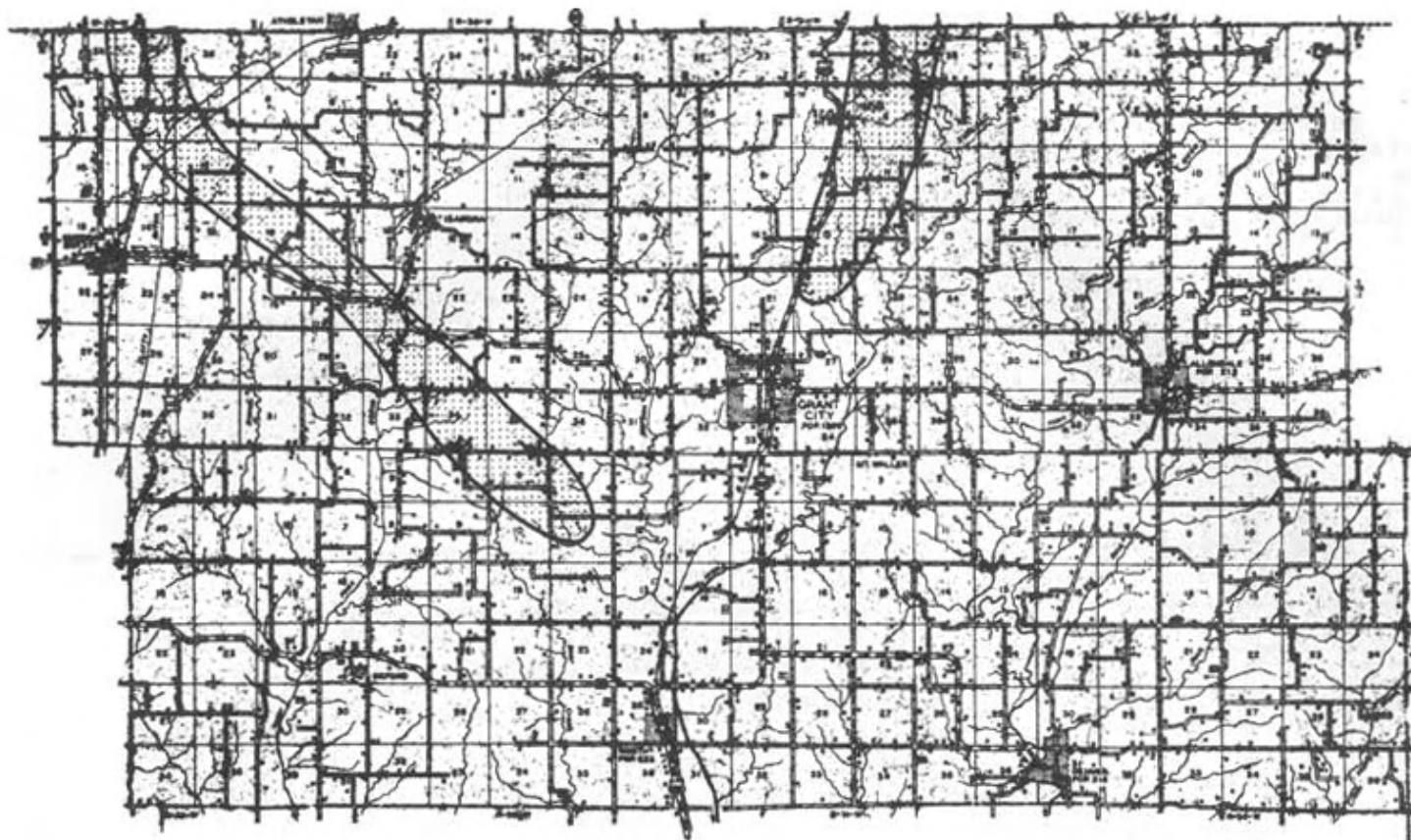


CONTOUR MAP OF WORTH COUNTY SHOWING BEDROCK ELEVATIONS BY

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NOVEMBER, 1956

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Base by the Missouri State Highway Department, 1949

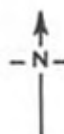
LEGEND



Drift filled valley



Test wells that flowed



MAP OF WORTH COUNTY SHOWING

DRIFT FILLED VALLEYS IN WHICH
IRRIGATION WELLS POSSIBLY CAN
BE DEVELOPED

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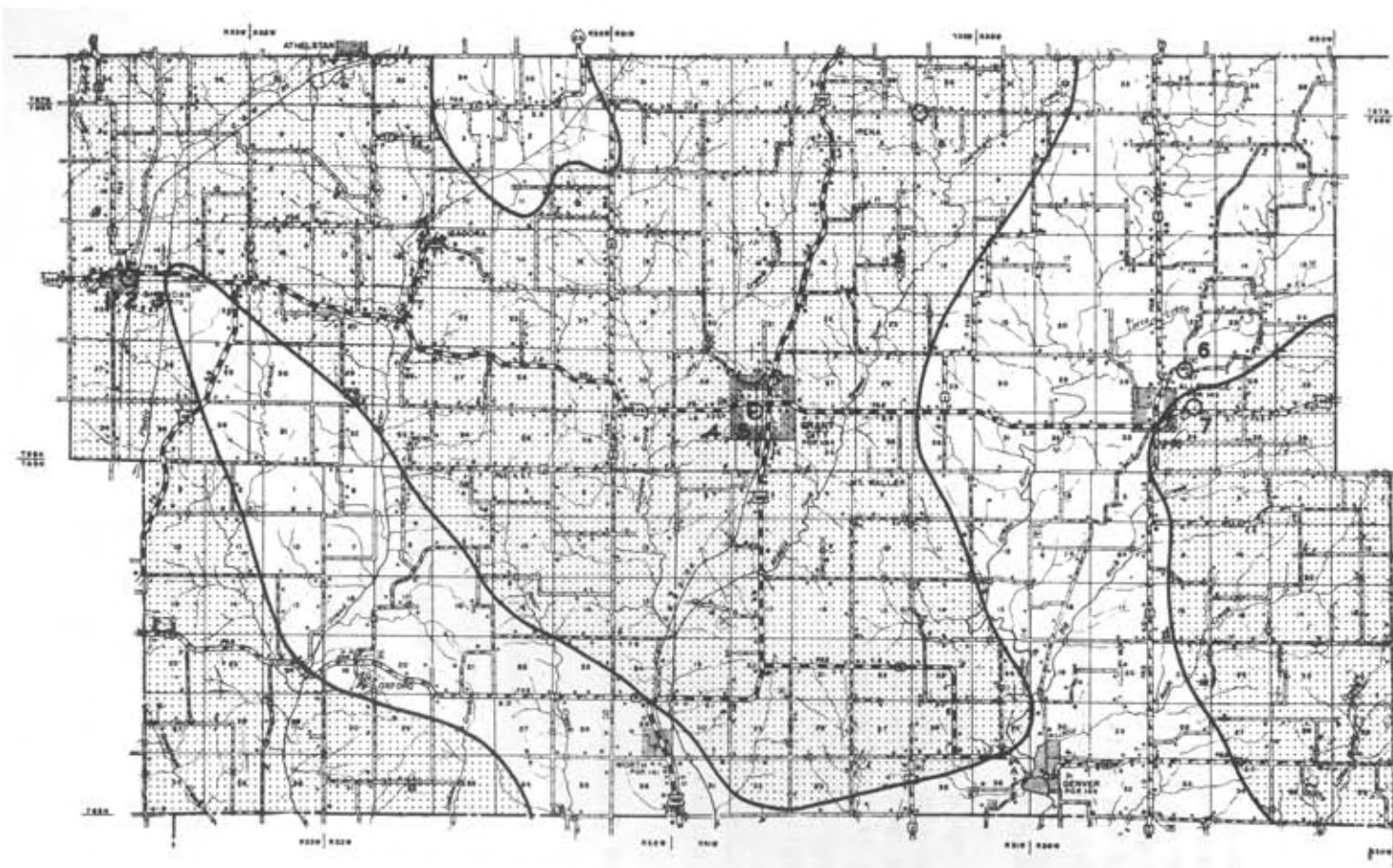
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NOVEMBER 1955

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PLATE 2



Base by the Missouri State Highway Department, 1955

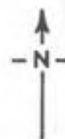
LEGEND



Area most favorable

○4

*Location of wells in drift from
which water was analyzed*



MAP OF WORTH COUNTY SHOWING

**AREAS MOST FAVORABLE FOR THE
DEVELOPMENT OF WELLS IN DRIFT**

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PLATE I

SUMMARY

Approximately 9,000 acres of Worth County are located within the area in which irrigation wells possibly can be developed. Nearly five-sevenths of Worth County's area is suitably located for obtaining water sufficient for domestic needs from the glacial drift.

Questions concerning water problems for a specific location should be sent to the Missouri Geological Survey and Water Resources, Buehler Park Box 250, Rolla, Missouri 65401.